

WO 99/55254

PCT/NL99/00255

-29-

Claims

1. Suturing means for connecting a tubular vascular prosthesis to a blood vessel in the body, characterized in that the suturing means comprise an internal, substantially annular body intended to be firmly connected to an outer end of the vascular prosthesis and to be received in the blood vessel, that the suturing means comprise an external annular body intended to lie clampingly on an outer wall of the blood vessel at least practically at the location of the internal annular body and that at least one of the two annular bodies is provided with suturing members which at least in connected situation thereof extend substantially radially in the direction of a wall of the blood vessel and grip at least in the vessel wall so as to effect an adequate fixation of at least the internal annular body.

2. Suturing means as claimed in claim 1, characterized in that the suturing members, at least in the connected situation, extend radially from a first of the two annular bodies and are received in the other of the two annular bodies to thus effect a firm mutual connection while enclosing the wall of the vascular prosthesis and the vessel wall.

3. Suturing means as claimed in claim 2, characterized in that the first annular body comprises a metal ring with lips which can be pressed radially outward and are provided with sharp protrusions which are capable of penetrating through the wall of the prosthesis, the wall of the blood vessel and into the material of the other of the two annular bodies.

4. Suturing means as claimed in claim 3, characterized in that the protrusions are provided with one or more barbed hooks.

5. Suturing means as claimed in ~~one or more of the claims 2-4~~ ^{claim 2 or 3 or 4}, characterized in that the suturing members extend from the internal annular body and that the external annular body comprises at least a core of plastic for receiving the suturing members therein.

6. Suturing means as claimed in ~~one or more of the claims 2-5~~ ^{claim 2}, characterized in that the means also comprise a clamping ring which is intended to lie against an outer

WO 99/55254

PCT/NL99/00255

-30-

wall of the prosthesis at least practically at the position of the internal annular body and herein exert at least locally a radially inward directed force.

7. Suturing means as claimed in claim 6, characterized in that the clamping ring comprises a crimp ring which can permanently decrease in diameter at increased temperature.

8. Suturing means as claimed in claim 1, characterized in that the suturing members comprise protrusions which extend from the internal annular body on a side thereof directed toward the blood vessel wall and are capable, at least under the influence of a radially directed force, of penetrating at least partially in the blood vessel wall to thus anchor the prosthesis therein.

9. Suturing means as claimed in claim 8, characterized in that the suturing members comprise a regular pattern of crater-like openings, the walls of which form the protrusions.

10. Suturing means as claimed in claim 8 or 9, characterized in that the internal annular body has an inner diameter which is at least practically equal to an outer diameter of the vascular prosthesis and that the internal annular body is intended to lie against an outer wall of the vascular prosthesis.

11. Suturing means as claimed in ~~one or more of the claims 8-10~~ ^{claim 2}, characterized in that the internal annular body comprises a deformable ring which in a first contracted state has a diameter which falls within the diameter of the blood vessel and in a second expanded state is able to lie against an inner wall of the blood vessel.

12. Suturing means as claimed in ~~one or more of the foregoing claims~~ ^{claim 1}, characterized in that the external annular body comprises a ring which is interrupted in at least one position and that at the location of ~~the interruption closing means~~ ^(the interruption closing means) are provided to mutually connect adjacent ring parts.

13. Suturing means as claimed in ~~one or more of the foregoing claims~~ ^{claim 1}, characterized in that the external annular body comprises at least on a side facing the blood vessel a regular pattern of cams with which the body supports on the blood vessel, which cams leave mutually free interspaces extending over the full width of the body.

WO 99/55254

PCT/NL99/00255

-31-

14. Branch means for connecting a side vessel of a main blood vessel to a vascular prosthesis arranged in the main blood vessel, comprising a flange-shaped internal body intended to lie against an inner wall of the vascular prosthesis, which flange-shaped body carries on its side directed toward the vascular prosthesis a hollow stem open on both sides as well as at least one suturing member, both of which are able to penetrate through the wall of the vascular prosthesis, and comprising a flange-shaped external body intended to lie round the side vessel against an outer wall of the main blood vessel at the position of the internal body, which external body is provided with a bore for receiving the side vessel and the stem therein, wherein at least in mutually connected state the suturing member is received in the external flange-shaped body, thus forming a firm mutual connection, and the stem is received in the side vessel, thus forming an open connection between the main blood vessel and the side vessel.

15. Branch means as claimed in claim 14, characterized in that the stem tapers to a point at its free end.

16. Branch means as claimed in claim 14 or 15, characterized in that the external disc-like body comprises a channel which provides access to the bore from a peripheral edge.

17. Branch means as claimed in ~~any of the claims 14-16~~ ^{claim 14}, characterized in that the internal body is manufactured from metal and the external body comprises a plastic.

18. Device for inserting and suturing a flexible tubular vascular prosthesis in the body, which prosthesis is provided on a free end with an annular body which lies against a wall thereof, comprising a flexible infeed line, which infeed line is provided on one end with a fixation member intended for receiving thereon the vascular prosthesis with the internal annular body, which fixation member is able when energized to exert a radially outward directed force on the annular element.

19. Device as claimed in claim 18, characterized in that the annular body comprises a metal ring with suturing members which can be pressed radially outward and that the fixation member is able to exert a radially outward directed force on at least the suturing members of the annular body.

20. Device as claimed in claim 19, characterized in that the suturing members comprise lips with sharp ends which are retracted and can be pressed radially outward

WO 99/55254

PCT/NL99/00255

-32-

and that the fixation member comprises a rotatable disc for receiving the annular body thereon, which disc is provided with recesses for receiving the lips of the annular body therein.

21. Device as claimed in claim 20, characterized in that the fixation member comprises two discs which are rotatable in opposing directions and are mutually adjacent and which together receive the annular body thereon, which discs are both provided with recesses for receiving therein lips of the annular body which are retracted in opposing directions and which can be pressed radially outward.

22. Device as claimed in claim 18, characterized in that the fixation member comprises an inflatable body which in a first at least partially evacuated state can be received in the prosthesis with the annular body and in a second filled state takes on a cylindrical shape coaxially with the prosthesis, an external diameter of which is at least practically equal to an internal diameter of the vascular prosthesis.

23. Device as claimed in claim 22, characterized in that in the second state the inflatable body is at least practically non-stretch and maintains an internal pressure in the order of magnitude of several tens of atmospheres.

24. Device as claimed in ^{claim 18} ~~one or more of the claims 18-23~~, characterized in that the device comprises a second fixation member intended for fixing a second annular body, which second annular body is intended for lying against an outer wall of a blood vessel and that monitoring means are provided for indicating the mutual position of both fixation members.

25. Vascular prosthesis comprising a flexible tubular body intended to be connected to a blood vessel with a first and a second end respectively at a first and a second location, characterized in that the tubular body comprises an opening in a wall thereof between the first and second end.

26. Vascular prosthesis as claimed in claim 26, characterized in that the tubular body comprises an externally directed collar around the opening.

27. Vascular prosthesis comprising a flexible tubular body of which at least a first end is intended to be connected to a blood vessel, characterized in that the tubular body is provided on at least the first end with an internal annular body of the suturing means ~~as claimed in one or more of the claims 1-13.~~

28. Vascular prosthesis as claimed in claim 27, characterized in that the tubular body is provided on at least the first outer end with an internal annular body of the suturing means as claimed in one or more of the claims 2-7, and that at the location of the internal annular body a clamping ring lies clampingly on an outer wall of the tubular body while enclosing the wall of the tubular body.

29. Vascular prosthesis as claimed in claim 27, characterized in that the internal annular body lies on an outer wall of the tubular body via a suitable glue connection.

30. Vascular prosthesis as claimed in one or more of the claims 27-29, characterized in that a second end of the tubular body is provided with coupling means which are capable of a liquid-tight coupling to a free end of a second flexible tubular body.

31. Vascular prosthesis as claimed in claim 30, characterized in that the coupling means comprise a rigid, tubular coupling element which is firmly connected on a first side to the second end of the tubular body and comprises on a second part a taper intended for clampingly receiving thereon said end of the second tubular body.

32. Vascular prosthesis as claimed in claim 31, characterized in that the coupling element is provided at the location of the taper with at least one external, tangentially running rib which extends over at least a part of the periphery of the taper.

33. Vascular prosthesis as claimed in claim 32, characterized in that the coupling element comprises at the location of the taper at least two external ribs which leave a certain interspace, which interspace is intended for receiving a clamping ring at that position which fixedly clamps the end of the second tubular body onto the taper.

34. Vascular prosthesis as claimed in one or more of the claims 27-33, characterized in that the tubular body comprises a main leg, between opposite ends of which at least one side leg extends, and that at least one of the free ends of the tubular body carries either an internal annular body associated with the suturing means as claimed in one or more of the claims 1-13 or carries coupling means capable of a liquid-tight connection to a free end of a second flexible tubular body.

35. Vascular prosthesis as claimed in claim 34, characterized in that the main leg is provided on either side with an internal annular body.

WO 99/55254

PCT/NL99/00255

-34-

36. Vascular prosthesis as claimed in claim 34 or 35, characterized in that two side legs extend from the main leg which are each provided on a free end with coupling means.

37. Vascular prosthesis as claimed in one or more of the claims 27-33,

5 characterized in that the tubular body comprises a primary leg with a first free end and a second end which divides into at least two secondary legs and that at least one of the free ends of the tubular body carries either an internal annular body associated with the suturing means as claimed in one or more of the claims 1-13 or carries coupling means capable of a liquid-tight connection to a free end of a second flexible tubular body.

10 38. Vascular prosthesis as claimed in claim 37, characterized in that the primary leg is provided on the first end with an internal annular body and that secondary legs each carry coupling means on their free end.

39. Vascular prosthesis as claimed in claim 37, characterized in that the secondary legs are provided on their free end with coupling means.

15 40. Vascular prosthesis system comprising mutually connectable modular prosthesis elements which each comprise a vascular prosthesis as claimed in any of the claims 27-39.